WHAT IS CLAIMED IS:

1   1.   A window position detection and anti-pinch system for a
2   vehicle door assembly having a window adjustably positionable in a window frame
3   by a reversible motor operatively connected to the window, the system comprising:
4   at least one sensing device disposed adjacent the window for
5   detecting the position of the window relative to the window frame, the at least one
6   sensing device generating an output signal representative of the detected position of
7   the window; and
8   a controller responsive to the output of the at least one sensing device
9   for comparing the output signal against predetermined values to determine whether
10   an obstruction exists between the window and window frame.

1   2.   The window position detection and anti-pinch system of claim
2   1 wherein the at least one sensing device comprises a first sensing device detecting
3   a coding arrangement provided on the window and generating an output
4   representative of the detected position of the indicia on the window.

1   3.   The window position detection and anti-pinch system of claim
2   2 wherein the at least one sensing device comprises a first sensing device having a
3   sensor detecting a coding arrangement located on the window and a transmitter
4   generating an output representative of the detected position of the indicia on the
5   window.

1   4.   The window position detection and anti-pinch system of claim
2   2 wherein the coding arrangement comprises a plurality of indicia uniformly spaced
3   and correlated to convey the vertical position of the window in the window frame
4   to the sensor.

1   5.   The window position detection and anti-pinch system of claim
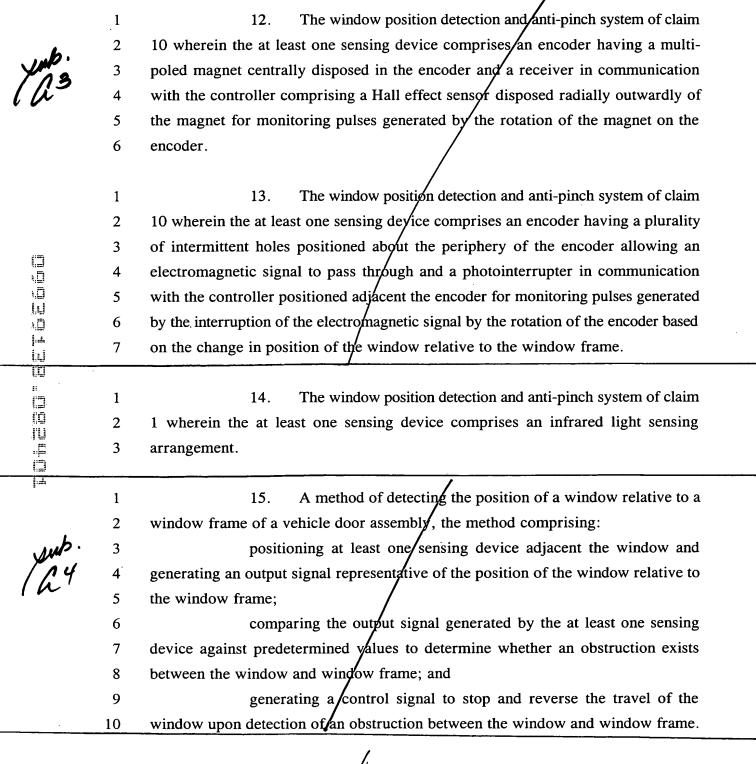2   4 wherein the coding arrangement is etched into a surface of the window.

1   6.   The window position detection and anti-pinch system of claim

2   4 wherein the coding arrangement is provided on a media applied to the window.

1   7.   The window position detection and anti-pinch system of claim

2   1 wherein the at least one sensing device includes a first sensing device for detecting

3   the position of the window relative to the window frame and a second sensing

4   device for detecting the presence of an obstruction between the window and window

5   frame.

1   8.   The window position detection and anti-pinch system of claim

2   7 wherein the second sensing device comprises a transmitter disposed adjacent an

3   upper rear portion of the window frame emitting an energy signal along the inner

4   periphery of the window frame, a receiver in communication with the controller

5   disposed adjacent a lower front portion of the window frame detecting the

6   electromagnetic signal and a prism positioned in the path of the energy signal

7   emitted by the transmitter and arranged to redirect the signal to the receiver.

1   9.   The window position detection and anti-pinch system of claim

2   8 further comprising a shutter mechanism arranged to block the energy signal if an

3   obstruction contacts a lower end of the shutter mechanism.

1   10.   The window position detection and anti-pinch system of claim

2   1 wherein the at least one sensing device comprises a rotary member engaging a

3   surface of the window and an encoder rotatably connected to the rotary member for

4   detecting the position of the window relative to the window frame, wherein the

5   encoder is rotated by the rotary member upon the movement of the window.

1   11.   The window position detection and anti-pinch system of claim

2   10 wherein the at least one sensing device comprises an encoder having a plurality

3   of electrical contacts provided on an outer periphery of the encoder and at least one

4   electrical contact in communication with the controller for monitoring pulses

5   generated by the rotation of the plurality of contacts on the encoder upon the

6   movement of the window.

1   12.   The window position detection and anti-pinch system of claim

2   10 wherein the at least one sensing device comprises an encoder having a multi-

3   poled magnet centrally disposed in the encoder and a receiver in communication

4   with the controller comprising a Hall effect sensor disposed radially outwardly of

5   the magnet for monitoring pulses generated by the rotation of the magnet on the

6   encoder.

1   13.   The window position detection and anti-pinch system of claim

2   10 wherein the at least one sensing device comprises an encoder having a plurality

3   of intermittent holes positioned about the periphery of the encoder allowing an

4   electromagnetic signal to pass through and a photointerrupter in communication

5   with the controller positioned adjacent the encoder for monitoring pulses generated

6   by the interruption of the electromagnetic signal by the rotation of the encoder based

7   on the change in position of the window relative to the window frame.

1   14.   The window position detection and anti-pinch system of claim

2   1 wherein the at least one sensing device comprises an infrared light sensing

3   arrangement.

1   15.   A method of detecting the position of a window relative to a

2   window frame of a vehicle door assembly, the method comprising:

3   positioning at least one sensing device adjacent the window and

4   generating an output signal representative of the position of the window relative to

5   the window frame;

6   comparing the output signal generated by the at least one sensing

7   device against predetermined values to determine whether an obstruction exists

8   between the window and window frame; and

9   generating a control signal to stop and reverse the travel of the

10   window upon detection of an obstruction between the window and window frame.

1   16.   The method of claim 15 wherein generating an output signal

2   comprises detecting a coding arrangement located on the window, wherein the

3   coding arrangement comprises a plurality of indicia uniformly spaced and correlated

4   to convey the vertical position of the window relative to the window frame.

1   17.   The method of claim 15 further comprising positioning a

2   second sensing device to detect the presence of an obstruction between the window

3   and window frame.

1   18.   The method of claim 17 wherein positioning the second

2   sensing device comprises providing a transmitter disposed adjacent an upper rear

3   portion of the window frame, emitting an energy signal along the inner periphery

4   of the window frame, and receiving the energy signal at a receiver disposed adjacent

5   a lower front portion of the window frame.

1   19.   The method of claim 15 wherein positioning the at least one

2   sensing device further comprises providing a rotary member disposed adjacent the

3   window and an encoder rotatably connected to the rotary member for detecting the

4   position of the window relative to the window frame.

1   20.   The method of claim 19 wherein providing an encoder

2   comprises providing an encoder having a plurality of electrical contacts provided

3   on an outer periphery of the encoder and at least one electrical contact in

4   communication with the controller for monitoring pulses generated by the rotation

5   of the plurality of contacts translated from a change in position of the window

6   relative to the window frame.

1   21.   The method of claim 19 wherein providing an encoder

2   comprises providing an encoder having a multi-poled magnet centrally disposed in

3   the encoder and a receiver in communication with the controller comprising a Hall

4   effect sensor disposed radially outwardly of the magnet for monitoring pulses

5   generated by the rotation of the magnet on the encoder translated from a change in

6   position of the window relative to the window frame.

1   22.   The method of claim 19 wherein providing an encoder

2   comprises providing an encoder having a plurality of intermittent holes positioned

3   about the periphery of the encoder allowing an electromagnetic signal to pass

4   through and a photointerrupter in communication with the controller positioned

5   adjacent the encoder for monitoring pulses generated by the interruption of the

6   electromagnetic signal by the rotation of the encoder based on the change in position

7   of the window relative to the window frame.